

## CLAIMS

### We Claim:

1. A viral immunogen derived from a mammalian virus and expressed in a plant.
2. The immunogen of claim 1 wherein at least a portion of said plant is edible.
3. The immunogen of claim 1 wherein said immunogen is a mucosal immunogen.
4. The immunogen of claim 3 wherein the mucosal immunogen is capable of binding a glycosylated molecule on the surface of a membrane of a mucosal cell.
5. The immunogen of claim 1 wherein said immunogen is a chimeric protein.
6. The immunogen of claim 1 wherein said immunogen is an immunogen derived from a hepatitis virus.
7. A viral mucosal immunogen derived from a hepatitis virus, wherein said immunogen is expressed in a plant, wherein said immunogen is capable of binding a glycosylated molecule on a surface of a membrane of a mucosal cell.
8. A transgenic plant comprising a plant expressing a recombinant viral immunogen derived from a mammalian virus.
9. The transgenic plant of claim 8 wherein said plant is edible.
10. The transgenic plant of claim 8 wherein said immunogen is a mucosal immunogen.
11. The transgenic plant of claim 8 wherein the mucosal immunogen is capable of binding a glycosylated molecule on the surface of a membrane of a mucosal cell.

- 1 12. The transgenic plant of claim 8 wherein said immunogen is a chimeric protein.
- 1 13. The transgenic plant of claim 8 wherein said immunogen is an immunogen derived from a  
2 hepatitis virus.
- 1 14. A transgenic plant expressing a recombinant viral mucosal immunogen of hepatitis virus,  
2 wherein said mucosal immunogen is capable of binding a glycosylated molecule on a surface  
3 of a membrane of a mucosal cell.
- 1 15. A vaccine comprising a recombinant viral immunogen expressed in a plant.
- 1 16. The vaccine of claim 15 wherein said immunogen is a mucosal immunogen.
- 1 17. The vaccine of claim 15 wherein the mucosal immunogen is capable of binding a glycosylated  
2 molecule on the surface of a membrane of a mucosal cell.
- 1 18. The vaccine of claim 14 wherein said immunogen is a chimeric protein.
- 1 19. The vaccine of claim 14 wherein said immunogen is an immunogen derived from a hepatitis  
2 virus.
- 1 20. A vaccine comprising a mucosal immunogen of hepatitis virus expressed in a plant, wherein  
2 said mucosal immunogen is capable of binding a glycosylated molecule on a surface of a  
3 membrane of a mucosal cell.
- 1 21. A food comprising at least a portion of a transgenic plant capable of being ingested for its  
2 nutritional value, said plant comprising a plant expressing a recombinant viral immunogen.
- 1 22. The food of claim 21 wherein said immunogen is a mucosal immunogen.
- 1 23. The food of claim 21 wherein the mucosal immunogen is capable of binding a glycosylated  
2 molecule on the surface of a membrane of a mucosal cell.
- 1 24. The food of claim 21 wherein said immunogen is a chimeric protein.

- 1 25. The food of claim 21 wherein said immunogen is an immunogen derived from a hepatitis  
2 virus.
- 1 26. A food comprising at least a portion of a transgenic plant capable of being ingested for its  
2 nutritional value, said plant expressing a recombinant viral mucosal immunogen of hepatitis  
3 virus, wherein said mucosal immunogen is capable of binding a glycosylated molecule on a  
4 surface of a membrane of a mucosal cell.
- 1 27. The food of any of claims 21-26 wherein said plant portion includes the fruit, leaves, stems,  
2 roots, or seeds of said plant.
- 1 28. A plasmid vector for transforming a plant comprising:  
2 a DNA sequence encoding a viral immunogen; and  
3 a plant-functional promoter operably linked to said DNA sequence capable of  
4 directing the expression of said immunogen in said plant.
- 1 29. The plasmid vector of claim 28 further comprising a selectable or scorable marker gene.
- 1 30. The plasmid vector of claim 28 wherein said plant promoter comprises CaMV35S.
- 1 31. The plasmid vector of claim 28 wherein said plant is edible.
- 1 32. The plasmid vector of claim 28 wherein said immunogen is a mucosal immunogen.
- 1 33. The plasmid vector of claim 28 wherein the mucosal immunogen is capable of binding a  
2 glycosylated molecule on the surface of a membrane of a mucosal cell.
- 1 34. The plasmid vector of claim 28 wherein said immunogen is a chimeric protein.
- 1 35. The plasmid vector of claim 28 wherein said immunogen is an immunogen derived from a  
2 hepatitis virus.
- 1 36. A plasmid vector for transforming a plant comprising:  
2 a DNA sequence encoding a mucosal immunogen of hepatitis virus, said mucosal  
3 immunogen capable of binding a glycosylated molecule on a surface of a membrane of a  
4 mucosal cell; and

1 a plant-functional promoter operably linked to said DNA sequence capable of  
2 directing the expression of said immunogen in said plant.

1 37. A DNA fragment useful for microparticle bombardment transformation of a plant comprising:  
2 a DNA sequence encoding a viral immunogen; and  
3 a plant-functional promoter operably linked to said DNA sequence capable of  
4 directing the expression of said immunogen in said plant.

1 38. The DNA fragment of claim 37 further comprising a selectable or scorable marker gene.

1 39. The DNA fragment of claim 37 wherein said plant promoter comprises CaMV35S.

1 40. The DNA fragment of claim 37 wherein said plant is edible.

1 41. The DNA fragment of claim 37 wherein said immunogen is a mucosal immunogen.

1 42. The DNA fragment of claim 37 wherein the mucosal immunogen is capable of binding a  
2 glycosylated molecule on the surface of a membrane of a mucosal cell.

1 43. The DNA fragment of claim 37 wherein said immunogen is a chimeric protein.

1 44. The DNA fragment of claim 37 wherein said immunogen is an immunogen derived from a  
2 hepatitis virus.

1 45. A DNA fragment for ballistically transforming a plant comprising:  
2 a DNA sequence encoding a mucosal immunogen of hepatitis virus, said mucosal  
3 immunogen capable of binding a glycosylated molecule on a surface of a membrane of a  
4 mucosal cell; and  
5 a plant-functional promoter operably linked to said DNA sequence capable of  
6 directing the expression of said immunogen in said plant.

1 46. A method for constructing a transgenic plant cell comprising the steps of:  
2 constructing a plasmid vector or a DNA fragment by operably linking a DNA  
3 sequence encoding a viral immunogen to a plant-functional promoter capable of directing the  
4 expression of said immunogen in said plant; and  
5 transforming a plant cell with said plasmid vector or DNA fragment.

1 47. The method of claim 46 further comprising the step of;  
2 regenerating a transgenic plant from said transgenic plant cell.

1 48. A method for producing a vaccine comprising the steps of:  
2 constructing a plasmid vector or a DNA fragment by operably linking a DNA  
3 sequence encoding a viral immunogen to a plant-functional promoter capable of directing the  
4 expression of said immunogen in said plant;  
5 transforming a plant cell with said plasmid vector or DNA fragment; and  
6 recovering said immunogen expressed in said plant cell for use as a vaccine.

1 49. The method of claim 48 further comprising the step of;  
2 prior to recovering said immunogen for use as a vaccine, regenerating a transgenic  
3 plant from said transgenic plant cell.

1 50. The method of claim 48 wherein said recovery step further comprises obtaining an extract of  
2 said plant cell.

1 51. The method of claim 49 wherein said recovery step further comprises harvesting at least a  
2 portion of said transgenic plant.

1 52. The method of claim 48 wherein said plant cell is transformed utilizing an Agrobacterium  
2 system.

1 53. The method of claim 52 wherein said Agrobacterium system is an Agrobacterium  
2 tumefaciens-Ti plasmid system.

1 54. The method of claim 48 wherein said plant cell is transformed utilizing a microparticle  
2 bombardment transformation system.

1 55. The method of claim 48 wherein said DNA sequence is a DNA sequence encoding a hepatitis  
2 virus immunogen.

1 56. The method of claim 48 wherein said plant is a tomato plant.

1 57. The method of claim 48 wherein said plant is a tobacco plant.

- 1 58. The method of claim 48 wherein said plasmid vector is a binary vector.
- 1 59. The method of claim 48 wherein said plasmid vector is an integrative vector.
- 1 60. The method of claim 48 wherein said plasmid vector is pB121.
- 1 61. The method of claim 48 wherein said plant cell is transformed by microinjection.
- 1 62. The method of claim 48 wherein said plant cell is transformed by polyethylene glycol  
2 mediated uptake.
- 1 63. The method of claim 48 wherein said plant cell is transformed by electroporation.
- 1 64. The method of claim 48 wherein said plant cell is transformed by microparticle bombardment.
- 1 65. The method of claim 48 wherein said plant cell is a cell of a dicotyledon.
- 1 66. The method of claim 48 wherein said plant cell is a cell of a monocotyledon.
- 1 67. A method of administering any of the vaccines of claims 15-20 comprising administering a  
2 therapeutic amount of said vaccine to a mammal.
- 1 68. The method of claim 67 wherein the administering of a vaccine further comprises a parenteral  
2 introduction of said vaccine into said mammal.
- 1 69. The method of claim 67 wherein the administering of a vaccine further comprises a non-  
2 parenteral introduction of said vaccine into said mammal.
- 1 70. The method of claim 69 wherein said non-parenteral introduction of said vaccine into said  
2 mammal further comprises an oral introduction of said vaccine into said mammal.
- 1 71. A method of administering an edible portion of a transgenic plant, which transgenic plant  
2 expresses a recombinant viral immunogen, to a mammal as an oral vaccine against a virus from which  
3 said immunogen is derived, comprising:  
4 harvesting at least an edible portion of said transgenic plant; and

feeding said harvested portion of said transgenic plant to a mammal in a suitable amount to be therapeutically effective as an oral vaccine in the mammal.

72. A method of producing and administering an oral vaccine, comprising the steps of:

constructing a plasmid vector or DNA fragment by operably linking a DNA sequence encoding a viral immunogen to a plant-functional promoter capable of directing the expression of said immunogen in a plant;

transferring the plasmid vector into a plant cell;

regenerating a transgenic plant from said cells;

harvesting an edible portion of said regenerated transgenic plants; and

feeding said edible portion of said plant to a mammal in a suitable amount to be therapeutically effective as an oral vaccine.